

Benchmark helium dimer and trimer calculations with a public few-body code

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We present detailed calculations of bound and scattering states of dimers and trimers of He to produce highly accurate data and to test a non-relativistic three-body code currently in development for public distribution. For these systems, uncertainties and inaccuracies in the fundamental constants frequently used in published works can substantially exceed numerical errors. Our benchmark calculations include specific estimates of the numerical accuracy of the calculations, and also explore sensitivity to fundamental constants and their uncertainties. The use of an inexact coupling constant in the previous calculations leads to 0.08% error for the ground state energy, 0.3% error for the excited state energy and up to 0.15% error for the atom-dimer scattering length in the system of three ${}^4\text{He}$ atoms. The corresponding errors for the unsymmetric ${}^4\text{He}_2\text{He}$ system are 0.3% for the bound state energy and 0.03% for the atom-dimer scattering length.

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